DOCUMENT RESUME

ED 161 946 TM 007 981

AUTHOR Bushnell, Don D.
TITLE Altering Test Environments for Reducing Test Anxiety and for Improving Academic Performance.
PUB DATE 30 Mar 78
NOTE 16p.

EDRS PRICE MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS *Academic Achievement; *Anxiety; Class Size; *Environmental Influences; Higher Education; Peer Influence; *Performance Factors; Response Style (Tests); *Stress Variables; Testing; *Testing Problems; Test Wiseness; Undergraduate Students
IDENTIFIERS Achievement Anxiety Test; Test Anxiety; Test Anxiety Questionnaire

ABSTRACT

To test the effects of altering situational variables in stressful examinations on high test anxious and low test anxious undergraduates, mid-terms and final examinations were administered in two environmental settings: large lecture halls and small language laboratories. Mean test scores for high test anxious students in the language labs were significantly higher than mean scores of high test anxious students taking the same tests in large lecture halls. Marginally low anxious students not seated adjacent to high test anxious students had mean test scores significantly higher than marginally low anxious students adjacent to high test anxious students. High anxious and low anxious students working in standard lecture halls had significantly different test scores while high anxious and low anxious students in language labs had no significant differences. In a follow-up study, it was found that stress reducing techniques administered at the beginning of stressful examinations eliminate the usual negative correlation between high test anxious states and final grades. It was concluded that environmental and situational variables have important differential effects on high and low anxious students, and mask learning performance. (Author/JAC)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED161946

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

24.23

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Don D. Bushell
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

ALTERING TEST ENVIRONMENTS FOR REDUCING TEST ANXIETY AND FOR IMPROVING ACADEMIC PERFORMANCE

Don D. Bushnell

Fielding Institute
Santa Barbara, California

30 March 1978

TM007 981

ABSTRACT

To test the effects of altering situational variables in stressful examinations on high test anxious (HA) and low test anxious (LA) undergraduates, mid-terms, and final exams were administered in two environmental settings: large lecture halls, small language laboratories. Mean test scores for HA S's in the language labs were significantly higher ($< .01$) than mean scores of HA S's taking the same exams in large lecture halls. Marginally low anxiety (MLA) S's not seated adjacent to HA S's had mean test scores significantly higher ($< .03$) than MLA S's adjacent to HA S's. LA and HA students working in standard lecture halls had significantly different test scores ($< .02$) while HA and LA S's in language labs had no significant differences. In a follow-up study, it was found that stress reducing techniques administered at the beginning of stressful examinations eliminate the usual negative correlation between HA states and final grades.

It was concluded that environmental and situational variables have important differential effects on HA and LA anxious students and mask learning performance.

ALTERING TEST ENVIRONMENTS FOR REDUCING TEST ANXIETY AND FOR IMPROVING ACADEMIC PERFORMANCE

Don D. Bushnell

Fielding Institute
Santa Barbara, California

Test anxiety is a near-universal experience for undergraduate students. But for high test-anxious persons (HA), the effect in test situations is to depress achievement test scores and GPA generally and to mask learning performance specifically (Alexander & Husek, 1962; Carrier & Jewell, 1966; Morris & Liebert, 1970). Marlett and Watson (1968) have described test anxious behavior rather succinctly: "The high test-anxious subjects (HA) report a disposition to be anxious about failure and a desire to avoid situations fraught with possible failure. The HA person spends a part of his task time doing things which are not task oriented. He worries about his performance, worries about how well others might do, ruminates over choices open to him, and is often repetitive in his attempts to solve the task (202-3)."

It has been hypothesized that two kinds of drives are evoked in the test situation: learned task drives and learned anxiety drives. The former are reduced by "responses or response sequences which lead to completion of the task (Mandler & Sarason, 1952:166)." The latter, the kind measured on test anxiety questionnaires, can elicit two classes of responses, those related to task completion, which are anxiety reducing, and those which interfere with task completion. The Achievement Anxiety Test (AAT) yields measures of both facilitating (related to completion of the task) and debilitating (related to interference with task completion) anxiety states whereas the Test Anxiety Questionnaire (TAQ) yields self-report measures of only the debilitating drive states. Typically the TAQ contains items that reflect degree of confidence about course examinations and various questions related to S's physiological state, e.g., awareness of heartbeat before and during testing, amount of tenseness felt, etc.

Liebert and Morris (1967) have posited that two components of test anxiety are found in the TAQ: worry (W) and emotionality (E). Worry is

defined as "cognitive concern about the consequences of failing, the ability of others relative to one's own, etc. (975)." Emotionality is defined as autonomic reactions to the stress of examination situations per se. Liebert and Morris devised a short-form test anxiety measure based on the TAQ items and utilized this form as an index of W and E in a series of studies that correlated a number of test related variables with measures of W and E.

Generally the Morris and Liebert research supports an attentional interpretation of test anxiety as opposed to an avoidance behavior interpretation, but both can be said to be related to what might be called an habitual anxiety response (Sarason, 1960). The attentional formulation holds that a HA S's response to a stressful examination situation is to divide attention between self and the task with self-evaluative, attention-in responses predominant. The HA S's attend to their internal states and give marginal attention to the examination while they are in the high anxiety drive state.

Treatment Applications for the Reduction of HA States

Given the Morris and Liebert attentional interpretation of test anxiety, an attentional treatment approach to the management of test anxiety would seem propitious. However most reports of treatment of test-anxious S's involve variations of systematic desensitization techniques (Emery & Krumboltz, 1967; Cohen, 1968; Suinn, 1968; Streiby, 1974) which assume that the principal defining characteristic of test anxiety is the emotional arousal (E) component. The literature on desensitization has contributed substantially to analysis of the efficacy of various components of the systematic desensitization procedure for test anxious subjects; for example, standardized vs individualized anxiety hierarchies, partial vs full hierarchies, relaxation only vs full desensitization, etc. Generally, the research indicates that such techniques have beneficial effects on self-reported measures of nervousness or heightened autonomic states, and often on scholastic performance. But we will not review this literature here. Desensitization exercises have the drawback of being cost-intensive in terms of man hours and the cost associated with implementing programs broad enough to reach a large population of test anxious students.

Another approach to the treatment of high test anxiety is to alter the situational variables in stressful test conditions. When a stimulus situation contains elements which specifically arouse test anxiety, it is

hypothesized that an increase in anxiety leads to lower performance of individuals who have task-irrelevant responses in their response repertory (the HA student) and improves performance of the person whose task-oriented responses are dominant (LA) (Mandler & Sarason ibid.; Zajonc, 1971). Hence, it is known that situational stress variables, factors which specifically arouse test or achievement anxiety, have a differential effect on HA and on LA students. Presumably, reducing situational stress variables would have providential effects for HA students while the level of task oriented demands of a major examination would hold sufficient arousal effects for the LA learner.

Four environmental variables are presumed to be dominant in actual test situations: (1) the size of the test location and the density of student seating, (2) distractions attendant upon the activities of students and monitors, (3) the proximity of LA and HA students in the seating arrangements, and (4) certain test embedding variables that define stress inducing characteristics of the test period, i.e., instructions prior to the test administration, the general mileau established by the instructor, etc. All such factors are presumed to be directly amenable to experimental manipulation.

Hypotheses

To test the effect of systematic variation of the above situational stress variables on test performance of HA and LA undergraduate students, a series of studies were undertaken over the past year at the University of California at Santa Barbara (UCSB). It was hypothesized that (1) HA S's would perform significantly better on mid-terms in test environments that provided visual isolation for each student and in which a relatively small number of students were seated, (2) LA S's would perform equally well in a large group, lecture hall test environment and in a small group environment under conditions of visual isolation, (3) marginally low anxious S's (MLA) would be distracted if seated immediately adjacent to HA S's and hence would receive significantly lower test scores than MLA's adjacent to LA S's.

Procedure

One hundred and twenty-five undergraduate students in an introductory course in Sociology at UCSB constituted the experimental population. Language laboratories accommodating no more than thirty students served as small group test environments and the option of visually isolating each student was elected. A standard lecture hall provided large group setting for the

control condition. This lecture hall was different from the one used regularly in the course.

S's completed an 11 item TAQ well in advance of the two Mid-Terms. Self-ratings of anticipated performance and of anxiety and emotionality during the Mid-Terms were scored for all students and those above 50th percentile were labeled HA and those below, LA. Examination scores were compiled by the same teaching assistants for all treatment groups and identical tests were administered to both experimental and control S's. All test procedures for the treatment groups were comparable. Seating arrangements were noted for the small group treatment condition and a Test Environment Questionnaire was administered to these groups.

Results

From several earlier studies utilizing the short-form TAQ questionnaire (Doctor & Altman, 1969; Liebert & Morris, ibid.; Morris & Liebert, 1969, 1970; Spiegler, Morris, & Liebert, 1968), it was anticipated that mean score differences between HA and LA S's taking their Mid-Terms under the large group, standard lecture hall condition would be significantly different. UCSB students in this control condition had test scores confirming this expectation. As shown in Table I, the mean test scores of LA and HA students in the large group test environments were significantly different ($<.02$, one-tailed test for both Mid-Terms).

TABLE I

T VALUE FOR DIFFERENCES BETWEEN MID-TERM SCORES OF LA AND HA S's IN LARGE GROUP TEST ENVIRONMENT

Variable		No. of Cases	Mean	Standard Deviation	F Value	2-Tail Prob.	* *	T Value	Degrees of Freedom	2-Tail Prob.
V6	1st Mid-Term						*			
LA	Group 1	37	70.3243	27.26	1.17	0.630	*	2.18	79	0.03*
HA	Group 2	44	56.4318	29.50			*			
V7	2nd Mid-Term						*			
LA	Group 1	44	78.6818	27.91	1.68	0.089	*	2.59	89	0.011*
HA	Group 2	47	61.0851	36.15			*			

*Significant at less than the .01 level, one-tailed test

Table II (below) shows that in the small group environment where students were visually isolated, differences between means of HA and LA S's were not at a level of significance that would cause us to reject the null hypothesis. The t-test probability for differences between mean scores of HA and LA S's on the first Mid-Term was .149 on a two-tailed test using a separate variance estimate of the t value. For the second Mid-Term, the probability of the differences between HA and LA S's was also not significant with a pooled variance estimate of the t-test at .310.

Contrasting the results of like groups in the two treatment conditions, we find highly significant differences (see Tables I and II) for the HA S's and marginally significant for the LA S's. HA S's administered their first Mid-Term in the large group control condition obtained mean scores of 56.4 (on a scale of 100) while HA S's in the small group treatment condition had means of 71.5, a difference at the .01 level (one-tailed test). More significant results were obtained in the second Mid-Term administration. HA S's in the large group lecture hall achieved mean test scores of 61.1 while their counterparts in the small group labs had means of 81.1; the t-test probabilities for differences between groups is significant at the .005 level (one-tailed test). For LA S's, comparison of mean test scores obtained in the two test environments shows differences in the same direction as obtained by HA S's but marginally significant. Mean scores for large group LA S's vs small on the first Mid-Term were 70.3 vs 79.4 significant at the .05 level (one-tailed), and on the second Mid-Term administration, 78.6 vs 86.1, a difference significant at the .06 level (one-tailed).

TABLE II

T VALUE FOR DIFFERENCES BETWEEN
GROUPS IN SMALL GROUP TEST ENVIRONMENT

Variable	Number of Cases	Mean	Standard Deviation	F Value	2-tail Prob.	T Value	Degrees of Freedom	2-tail Prob.
V6 1st midterm								
LA Group 1	25	79.3600	20.488					
HA Group 2	19	71.4737	12.843	2.54	0.046	1.47	42	0.149
V7 2nd midterm								
LA Group	18	86.1667	15.066					
HA Group 2	16	81.0625	13.631	1.22	0.702	1.03	32	0.310

Evidence of the beneficient effects of the small group setting on test performance of HA S's is also found in the Pearson product correlation coefficients run for students operating in the two different environmental conditions. Contrary to the findings of other test anxiety studies using the same self-report TAQ test, the correlations between test anxiety (V3) and Mid-Term scores (V6 and V7) were marginal or non-significant for small group environment S's and significant for those working in the large group, lecture hall environment (see Table III), i.e., on Mid-Term I (at the .001 one-tailed test), and marginally significant on Mid-Term II (.05 level), one-tailed test.

The variables, as shown in Table III, are as follows:

V1 and V2: Worry (W) and Emotionality (E) scores derived from the TAQ questionnaire.

V3: Sum of individual S's scores on the TAQ.

V4: Baseline pulse rate measures taken at the outset of the course.

V5: A code variable corresponding to HA or LA states (equivalent to V3).

V6: Mid-Term I scores.

V7: Mid-Term II scores.

TABLE III

PEARSON-PRODUCT CORRELATIONS FOR COMBINATIONS OF VARIABLES AND LEVELS OF SIGNIFICANCE FOR r COMPUTED FOR SMALL AND LARGE GROUP ENVIRONMENTS: MID-TERM I AND MID-TERM II

SMALL GROUP ENVIRONMENT

			V1	V2	V3	V4	V5	V6	V7
V3	1st Mid-Term	r	0.8325	0.8899	1.0000	-0.0915	0.5040	-0.1829	-0.1331
		N	(52)	(52)	(0)	(52)	(52)	(52)	(52)
		Prob.	S=0.001	s=0.001	s=0.001	s=0.259	s=0.001	S=0.097	S=0.174
V3	2nd Mid-Term	r	0.8963	0.9527	1.0000	-0.1023	0.5926		-0.0960
		N	(38)	(38)	(0)	(38)	(38)	N/A	(38)
		Prob.	S=0.001	S=0.001	S=0.001	S=0.271	S=0.001		S=0.283

LARGE GROUP ENVIRONMENT

V3	1st Mid-Term	r	0.9068	0.9362	1.0000	0.0539	0.6055	-0.3108	-0.1510
		N	(78)	(78)	(0)	(78)	(78)	(78)	(78)
		Prob.	S=0.001	S=0.001	S=0.001	S=0.320	S=0.001	S=0.003	S=0.093
V3	2nd Mid-Term	r	0.8774	0.8929	1.0000	0.0846	0.5484		-0.1344
		N	(87)	(87)	(0)	(87)	(87)	N/A	(87)
		Prob.	S=0.001	S=0.001	S=0.001	S=0.218	S=0.001		S=0.107

While it can be argued that the small test environment is less distracting for students taking their examinations than the large group setting, the relative proximity of HA students could affect the performance of those students whose anxiety states have a high degree of lability. It might be argued that marginally low anxious students seated immediately adjacent to high anxiety students could be distracted by the behavior of the HA S's. Given the conditions of the language lab environment, visual distraction would not in all probability present itself as a critical factor as students are visually isolated from each other by the panels of the individual booths, but other distractions such as the vocal sounds emitted, the pheromones (odors) given off, the restlessness evidenced--all could contribute to increased anxiety states in the marginally anxious student.

Table IV compares the differences in mean test scores for two groups of marginal LA S's (defined as S's with TAQ scores between 45th and 50th percentiles), one group of individuals comprised of those not seated adjacent to HA S's and the other group made up of individuals seated next to HA S's on the second Mid-Term (data for the first Mid-Term was contaminated, hence not of use in this analysis.

TABLE IV

COMPARISONS OF TEST SCORES OF MARGINAL LA S's
SEATED ADJACENT TO OR NOT ADJACENT TO HA S's IN
THE SMALL GROUP ENVIRONMENT AND T-TEST COMPARISONS

	Second Mid-Term Test Scores				
Anxiety State	N	M	S.D.	t-test	Prob.
Marginal LA S's - Adj.	8	68.57	10.59	2.55	.025*
Marginal LA S's - ~Adj.	8**	89.00	11.20		

*One-tailed test
**Two S's were isolated in the back of the lab.

Discussion

In contrasting the Mid-Term scores of students at two different levels of self-reported test anxiety, HA and LA, we see evidence that reducing situational stress factors, e.g., distractions due to large group pressure, noise level, visual proximity of other students, etc., benefits both categories of students, although differentially. Of the three hypotheses stated above, we find two confirmed and a third unconfirmed.

1. We predicted that HA S's would perform significantly better on their mid-terms in relatively small group environments

that afforded visual isolation than HA S's required to sit for their examination in a typical, large group, lecture hall examination setting. This hypothesis was supported as HA S's administered their first Mid-Term in the language labs achieved a mean test score significantly higher (at the .01 level) than their counterparts in the lecture hall. Similarly, HA S's taking the second Mid-Term in the labs obtained higher scores (at the .005 level) than HA S's in the lecture hall setting. Furthermore, the mean scores of HA S's in the language labs were not significantly different from the LA S's in the same setting but, as anticipated from previous studies, mean scores obtained by HA and LA S's in the standard lecture hall setting were significantly different (at less than .02).

2. It was predicted that LA S's would perform equally well on their mid-terms in either standard or language lab environments. This hypothesis was not substantiated. There was a significant difference between mean scores for LA S's on the first Mid-Term in the two experimental conditions (at the .05 level, one-tailed test), and for the second Mid-Term, a marginally significant difference (at the .06 level). Apparently the distracting factors in the large group setting outweighed the importance of the arousal effect that Zajonc (ibid.) predicted would facilitate task performance.

3. We predicted that marginally low anxious students (MLA) seated immediately adjacent to HA S's would receive significantly lower test scores than MLA's adjacent to LA S's. This hypothesis was confirmed as the results showed MLA S's adjacent to HA S's obtained lower mean scores significantly different (at the .025 level) from MLA S's found adjacent to LA S's.

It is difficult to speculate on the particular factors affecting this difference in performance as all S's were visually isolated from each other and it was expected that distracting factors would be attenuated by visual isolation. It would also be highly speculative on the basis of such a small N to generalize to other student populations. However, the same result was extant in the first Mid-Term for MLA's in the language labs with differences running at the .025 level (one-tailed test) between adjacent and non-adjacent S's. Not all S's in this first experimental treatment condition were accurately located in their seating arrangement however so the data from the first test administration had to be considered contaminated on this measure.

Earlier it was postulated on the basis of the Morris and Liebert (ibid.) research findings and those of their colleagues that HA and LA S's differentially divide their attention between focusing on feelings and focusing on the task of performing in the test situation. LA S's, according to Morris and Liebert, et al, focus almost exclusively on task performance from the onset of the exam hence, presumably, are not as readily distractable by environmental factors. The results as shown in Tables I, II, and II in this study tend to question that assumption. The large group setting for stressful examinations appears to be sufficiently distracting to depress the test scores of even the less anxious students. While the results show less significant effects from differences in the environmental settings for the LA S's in contrast with HA, such factors as seating arrangement, density of students, visual distractions, and other environmentally related variables apparently interact with performance of all students.

From the beneficial effects evident for both HA and LA S's in the language laboratory environment, it can be concluded that application of these frequently under-used facilities for test administration could be providential for students. Language labs now are extant on most campuses and provide visual isolation and comfortable seating with sufficient desk space for 30 to 35 students. And while 70 percent of the students tested in the language lab setting responded negatively to the Test Environment Questionnaire (the responses principally revolved around the prohibiting appearance of the electronic equipment in the labs), it is clear from the test results that language labs can be used effectively as special purpose settings for test administration.

An unanticipated result of the study, and one that was followed up in subsequent explorations, was the effectiveness of the 11 item TAQ in predicting failing grades and drop-outs in large undergraduate courses where environmental matters were not taken into account. The TAQ was administered in two other survey courses on the first or second meeting of the classes in lecture and was found to have considerable predictive power for subsequent student performance in the classes. Students in these courses (420 in all) who scored above the median on the short-form TAQ accounted for 77 percent of all students receiving a C- or worse at the end of the quarter. HA scores also identified 78 percent of all drop-outs from the courses and 73 percent of students requesting an Incomplete. Yet, in the populations sampled, HA students comprised only 44 percent of the total class populations.

We found the use of the TAQ to have practical value in identifying the students who needed special attention in these courses.

In a follow-up study, HA students identified in our introductory courses during the fall and winter quarters of 77-78 were given special treatment during their enrollment in these classes. Of special interest here was our attempt to improve the embedding factors present at the onset of several examinations in order to improve the general mileau of the typical large group, lecture hall setting. At four major test administrations, both mid-terms and finals, the faculty persons were instructed to help induce a relaxed atmosphere at the outset of the examination by prefacing their instructions with a humorous anecdote, making available (by way of assistants roaming the aisles) free "test food"--packages of raisins, nuts, and gum-- and maintaining stacks of free blue books and having available sharpened pencils. The results of this manipulation of stress factors typically present in the environment were encouraging. While HA S's comprised 40 percent of all students in the two courses sampled, they accounted for only 18 percent of the failing grades, only 20 percent of all drop-outs, and surprisingly comprised 43 percent of all A's and B's given at the conclusion of the courses. These results are strikingly different from those reported earlier in courses not so manipulated. And while no t-tests were run on differences between mean scores of HA and LA students, it became clear from examination of the data that the usual negative correlation between test anxiety and performance on final examinations was not obtained.

It is difficult to separate out the effects of the different techniques applied formally and informally to the problem of reducing test anxiety, but it seems fair to conclude that environmental variables are worthy of further examination. It should also be noted that such variables are independent of course content and other factors inherant in the instruction program. Environmental factors are more readily controlled. Techniques such as administering free test food and making available inexpensive supplies in support of the testing process take little planning and are easily administered. The beneficial results of such interventions are satisfying for both faculty and students.

When a test environment contains elements which specifically and unnecessarily arouse test or achievement anxiety, such stimulus elements discriminate between individual students with and without anxiety response tendencies. Such discrimination, we contend, masks learning performance and

subverts the purpose of assessment. We urge that environmental and situationally related variables inherent in test situations be analyzed and empirically explored.

Summary

To test the effects of altering situational variables in stressful examinations on high test anxious (HA) and low test anxious (LA) undergraduates, mid-terms were administered in two environmental settings: large lecture halls and small language laboratories. Mean test scores for HA S's in the language labs were significantly higher ($\leq .01$) than mean scores of HA S's taking the same exams in the lecture halls. Marginally low anxiety (MLA) S's not seated adjacent to HA S's had mean test scores significantly higher ($\leq .03$) than MLA S's adjacent to HA S's. LA and HA students working in standard lecture halls had significantly different test scores ($\leq .02$) while HA and LA S's in language labs had no such differences. In a follow-up study, it was found that stress reducing techniques administered at the beginning of stressful examinations eliminate the usual negative correlation between HA states and final grades.

BIBLIOGRAPHY

Alpert, R., & Haber, R. N. Anxiety in academic achievement situations. Journal of Abnormal and Social Psychology, 1963, 66, 207-216.

Alexander, S., & Husek, T. R. The anxiety differential: Initial steps in the development of a measure of situational anxiety. Educational and Psychological Measurement, 1962, 22, 235-348.

Ax, A. F. The physiological differentiation between fear and anger in humans. Psychosomatic Medicine, 1953, 15, 433-442.

Campos, J. J., & Johnson, H. J. The effects of verbalization instructions and visual attention on heart rate and skin conductance. Psychophysiology, 1966, 2, #1, 305-310.

Carver, N., & Jewell, D. Efficiency in measuring the effect of anxiety upon academic performance. Journal of Educational Psychology, 1966, 57, 23-26.

Cook, J. Additional variables in autonomic measurement. Psychophysiology Newsletter, 1963, 9, 14-22.

Berry, J. L., & Martin, B. GSR reactivity as a function of anxiety, instructions, and sex. Journal of Abnormal Social Psychology, 1957, 54, 9-12.

Cohen, R. The effects of group interaction and progressive hierarchy presentation on desensitization of test anxiety. Behavior Research and Therapy, 1969, 7, 15-26.

Emery, J. R., & Krumboltz, J. D. Standard versus individualized hierarchies in desensitization to reduce test anxiety. J urnal of Counseling Psychology, 1967, 14, 204-209.

Doctor, R., & Altman, F. Worry and emotionality as components of test anxiety: replication and further data. Psychological Reports, 1969, 24, 563-568.

Kagan, J., & Moss, H. A. Birth to Maturity: A Study in Psychological Development. New York: John Wiley, 1962.

Lacey, J. I. The evaluation of autonomic responses: toward a general solution. Annals of New York Academy of Sciences, and in Research in Psychotherapy, (Eds.) E. A. Rubinstein & M. B. Parloff. Washington, D. C., American Psychology Assoc., Washington, D. C. 1959, 160-207.

Liebert, R. M., & Morris, L. W. Cognitive and emotional components of test anxiety: A distinction and some initial data. Psychological Reports, 1967, 20, 975-978.

Mandler, G., & Sarason, S. B. A study of anxiety and learning. Journal of Abnormal and Social Psychology, 1952, 47, 166-17

Marlett, N. J., & Watson, D. Test anxiety and immediate or delayed feedback in a test-like avoidance task. Journal of Personality and Social Psychology, 1968, 8, 200-203.

Morris, L. W., & Liebert, R. M. Relationship of cognitive and emotional components of test anxiety to physiological arousal and academic performance. Journal of Consulting and Clinical Psychology, 1970, 35, 332-337.

Martin, B. The assessment of anxiety by physiological behavior measures. Psych. Bulletin, 1961, 58, 234-255.

Obriest, P. A. Cardiovascular differentiation of sensory stimuli. Abstr. of Meetings of the American Psychosomatic Society, 1962.

Sarason, I. G. Empirical findings, and theoretical problems in the use of anxiety scales. Psych. Bulletin, 1960, 57, 403-415.

Spiegler, M. D., Morris, L. W., & Liebert, R. M. Cognitive and emotional components of test anxiety: temporal factors. Psychological Reports, 1968, 22, 451-456.

Sassenrath, J. M. Anxiety, aptitude, and achievement. Psychology in the Schools, 1967, 4, 341-345.

Suinn, R. M. The desensitization of test-anxiety by group and individual treatment. Behavior Research and Therapy, 1968, 6, 385-387.

Weiner, H. Some psychological factors related to cardiovascular responses: a logical and empirical analysis. In R. Roessler and N. Greenfield (eds.) Physiological Correlates of Psychological Disorders. Madison: Univ. of Wisconsin Press, 1962.

Southard & Katahn, M. The correlation between self-reported and mechanically-recorded pulse rates. Psychonomic Science, 1967, 8, 343-344.

Wine, J. Test anxiety and direction of attention. Psychological Bulletin, 1971, 75, 92-104.

Zajonc, R. B. Limiting condition of the exposure effect: satiation and relativity. Journal of Personality and Social Psychology, 1971, 18, 384-391.